

[72] Inventor **Douglas D. Carden**
Barneveld, Wis.
 [21] Appl. No. **869,518**
 [22] Filed **Oct. 27, 1969**
 [45] Patented **July 6, 1971**
 [73] Assignee **Air Reduction Company**
New York, N.Y.

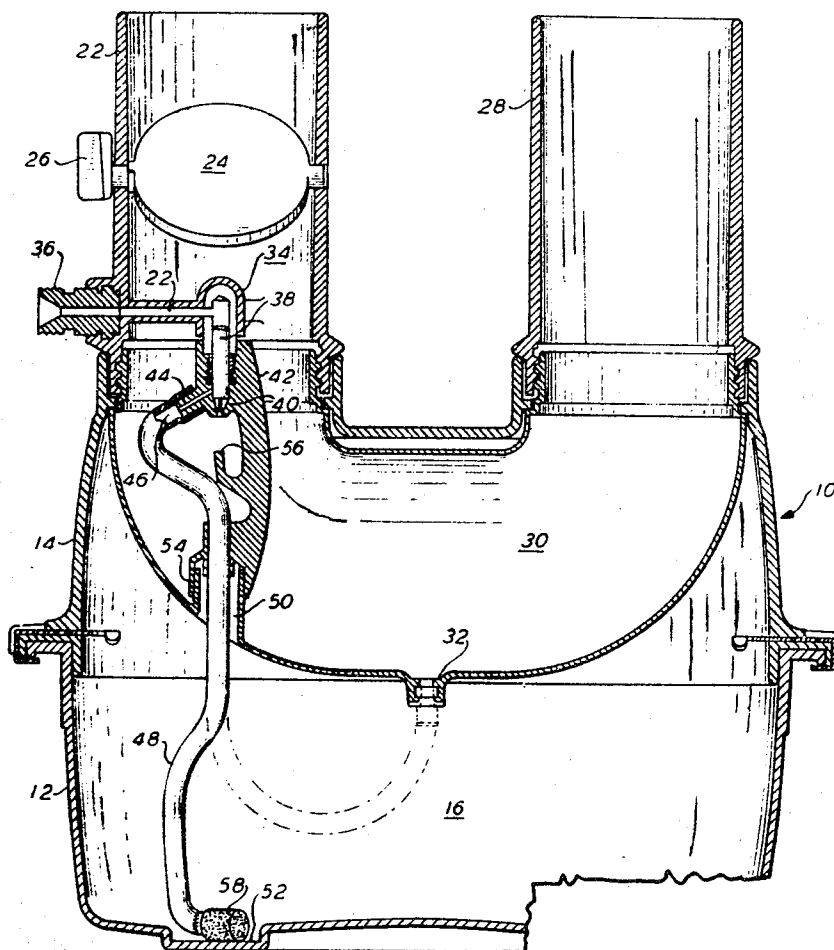
[56] **References Cited**
UNITED STATES PATENTS
 2,785,923 3/1957 Hickman 239/307
 2,869,188 1/1959 Cameto 239/338 X
 3,206,175 9/1965 Boteler 239/338 X

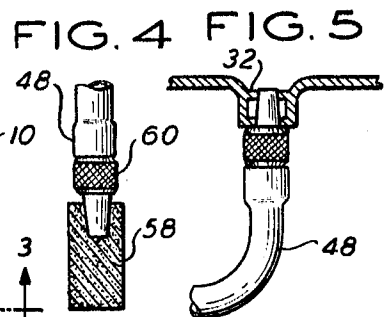
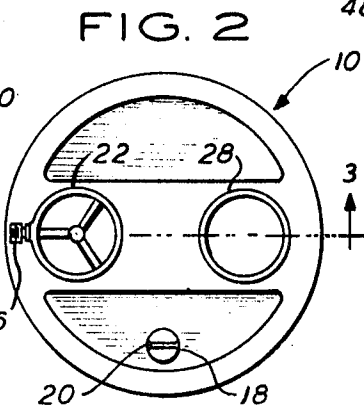
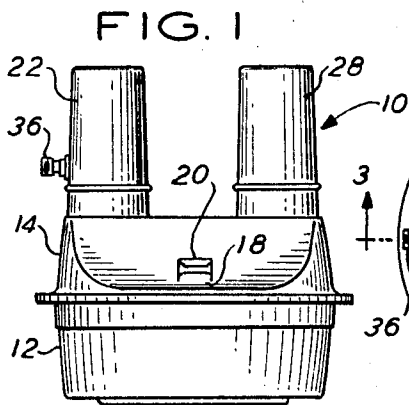
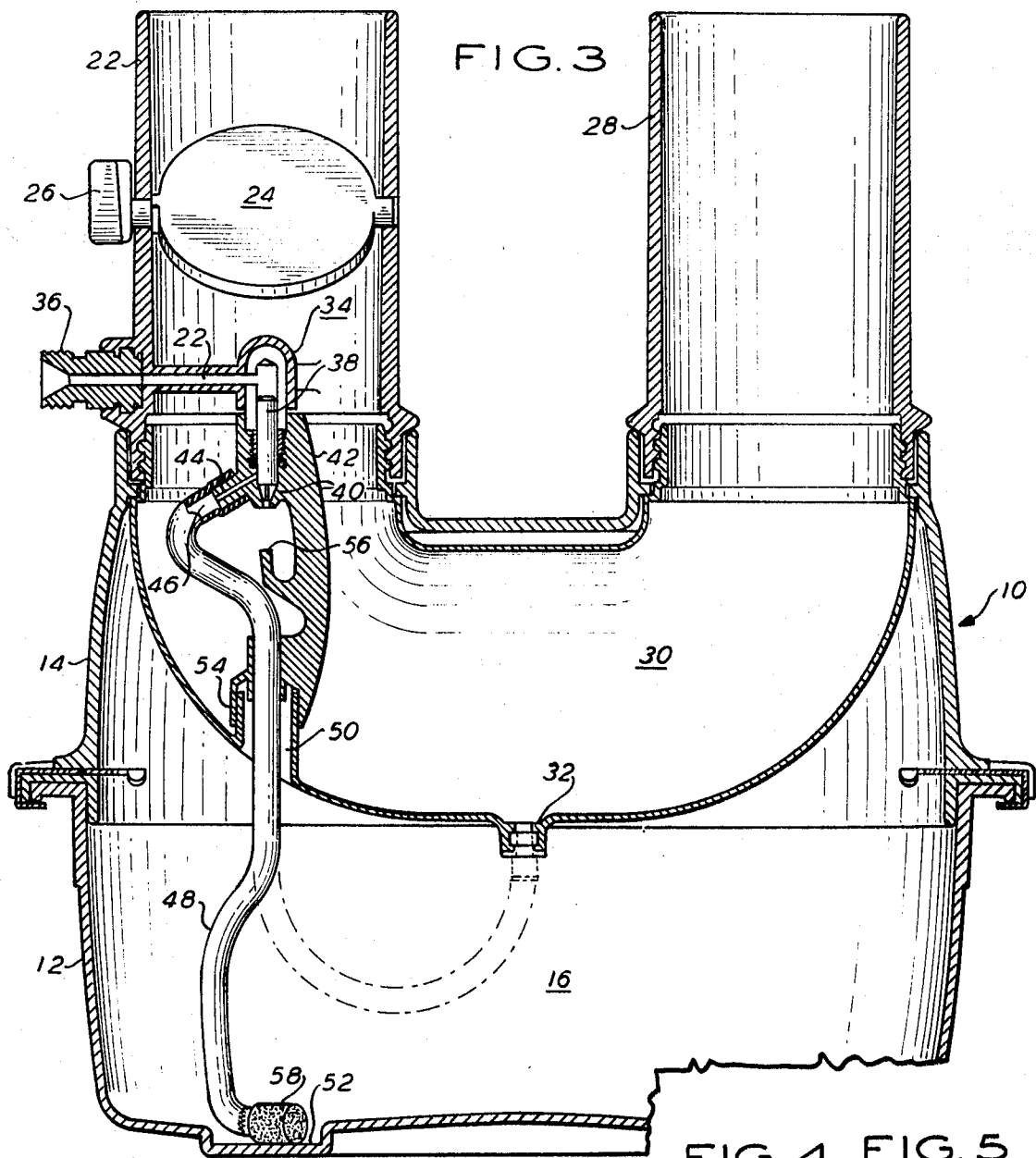
Primary Examiner—Lloyd L. King
Assistant Examiner—John J. Love
Attorneys—H. Hume Mathews, Edmund W. Bopp, Larry R. Cassett and Roger M. Rathbun

[54] **NEBULIZER**
7 Claims, 5 Drawing Figs.

[52] U.S. Cl. **239/305,**
 239/307, 239/338
 [51] Int. Cl. **A61m 11/02**
 [50] Field of Search. 239/305,
 337, 338, 304—308, 340, 370; 128/194

ABSTRACT: A mechanical nebulizer having a first reservoir for containing bulk use fluid for nebulization and a second reservoir for containing a medicament whereby the medicament may be selectively and independently supplied for nebulization and wherein circulation of fluid is provided during nebulization of either the bulk fluid or the medicament.





INVENTOR
DOUGLAS D. CARDEN
BY *[Signature]*
ATTORNEY

NEBULIZER

BACKGROUND OF THE INVENTION

The present invention relates to apparatus for the creation and administration of a fine aerosol mist, and more particularly, to a mechanical nebulizer having provision for separately containing and dispensing a bulk use fluid such as water and a suitable medicament for therapeutic purposes.

Heretofore, various means of including the nebulization of medicaments have been used with aerosol dispensing apparatus. Among the known methods is the addition of a separate medicament container which selectively allows medicament to enter into an atomized mist to thereafter be carried to the patient. Such containers were, however, generally small in size, were costly to include with a nebulizer and failed to provide for recirculatory circuits whereby large droplets, collected during nebulization from the mist stream, could be returned to the medicament container for further circulation.

Other prior art apparatus for nebulization of a medicament include the direct introduction into the normally very large main reservoir of the various medicaments. Such large reservoirs are, however, not generally suitable for use with medicaments in that such medicaments are usually very expensive and administered in relatively small quantities. It is, therefore, necessary to nebulize the maximum amount of medication in order to avoid waste and also to most accurately apply a prescribed quantity of such medicament to a user. Large reservoirs therefore, generally failed to utilize the maximum amount of medicament and caused waste and uncertain distribution of small quantities of medication.

Accordingly, it is an object of the present invention to provide high output aerosol administering device of a compact and convenient arrangement having provision to administer a medicament medication.

A further object of the invention is to provide a high output nebulizer construction which is capable of independently receiving and dispensing a relatively large quantity of a medicament for nebulization, yet which efficiently utilizes the maximum quantity of such medicament and thereby almost eliminates waste or unused medication.

A still further object of the invention is to provide a high output nebulizer apparatus having means to independently receive and nebulize a quantity of medicament, and whereby large droplets of medicament which are collected from the mist are returned through a recirculating circuit to be reintroduced to the mist.

Another object of the invention is to provide a high output nebulizer having a large reservoir for retaining a suitable liquid to be nebulized, and a relatively small separable reservoir which may selectively be used to retain another desired liquid to be nebulized, thereby isolating the large reservoir from the nebulization stream during use of the small reservoir.

Other objects and advantages of the present invention will be better understood by reference to the following description of the preferred embodiment taken in connection with the attached drawings wherein:

FIG. 1 is a side view of a nebulizer constructed in accordance with the present invention;

FIG. 2 is a plan view of the nebulizer;

FIG. 3 is a vertical sectional view, partially broken away, taken along the lines 3-3 of FIG. 2;

FIG. 4 is an enlarged view, partially in section, showing the end of an aspirating tube of the present invention; and

FIG. 5 is an enlarged view, partially in section, showing the same aspirating tube arranged for receiving a medicament.

Referring now to FIGS. 1-3, there is shown a nebulizer having an outer casing 10 which may be of a generally high impact strength plastic material. For convenience of assembly and disassembly, the casing 10 is constructed in separable parts, as shown, and comprises a lower housing 12 and an

upper housing 14 which is adapted to fit over and be supported by the lower housing 12.

The lower housing 12 is so constructed such that the interior thereof forms a large reservoir for containing a liquid to be nebulized. In an actual construction, the total usable volume of the large reservoir 16 may be in the order of 2500 cc. and may be filled through a suitably located opening 18 in the upper housing 14, into which is retained a plug 20.

An air inlet means is associated with the casing 10 and comprises an upstanding cylindrical intake tube 22 which, if desired, may be provided with a filter, not shown, to remove particulate impurities from the surrounding air. A control valve 24 having an external operating knob 26 is provided to control the quantity of air admitted through the intake tube 22 and normally allows fairly precise control thereof.

An outlet means is also provided in association with casing 10 and is also of upstanding cylindrically shaped outlet tube 28 which allows distribution of an aerosol to the surrounding atmosphere.

Both the inlet tube 22 and the outlet tube 28 are of a predetermined internal diameter at their outer extremities in order to be connectable, if desired, to conventional sized tubing, conduit, or used with standard adapters for any other sized tubing. In this manner, the nebulizer may be readily connected to a utilization means such as an oxygen tent without further alteration and facilitates replacement of existing nebulizers.

An intermediate, relatively small medicament reservoir 30 is provided within the casing 10, and may conveniently be located having its upper peripheral edge associated with the upper housing 14 as shown in FIG. 1. The medicament reservoir 30 is also preferably formed of a high impact strength plastic. At the lowermost extremity of medicament reservoir 30 is an opening 32 which normally provides open communication of the medicament reservoir 30 with large reservoir 16, the purpose of which will be explained later.

The nebulizer 34 is provided adjacent the air inlet means and comprises an external inlet connection 36 of standard design and which is adapted to be connected to a high pressure source of fluid, such as oxygen or compressed air which typically may be from 30 to 50 p.s.i. As shown, the inlet connection 36 is rigidly affixed to the body of the air inlet tube 22 and communicates with a passageway to cylindrical jet member 38 having an orifice 40 therein. A nebulizer body 42 is provided including a tube 44 having one end of tube 44 in open communication with the cylindrical jet member 38 and the other end thereof in communication with a downwardly extending aspirating tube 48. The aspirating tube 48 is of a flexible material, such as silicone rubber, and extends through an opening 50 in the bottom wall of medicament reservoir 30 downwardly such that its end is freely suspended adjacent a circular depression 52 in the bottom of the large reservoir 16. A flanged shroud 54 seals the opening 50 in the medicament reservoir 30 against the aspirating tube 48, thereby preventing other liquids from leaking through the opening 50 into the large reservoir 16, the purpose of which will be later explained. A baffle 56 is provided opposite and in alignment with the orifice 40. As shown, this baffle 56 is a cylindrical-shaped stub; however, it may be of any desired configuration including a spherically shaped surface.

At the lowermost end of aspirating tube 48, there is included a filter 58 for eliminating undesirable impurities from the nebulizing liquid prior to its introduction into aspirating tube 48. In the preferred embodiment, as shown in FIG. 4, this filter 58 is removable from the aspirating tube 48 and may easily be made removable by a force fit between an inwardly tapered internal surface of the filter 58 and a complementary tapered external surface of fitting 60 attached to the aspirating tube 48.

In the operation of the high output nebulizer of the present invention, high pressure air or oxygen is introduced into external inlet connection 36 and thereby through the cylindrical jet member 38 and emerges through orifice 40. As this gas flows

through orifice 40, it creates a suction pressure acting through the tube 44 which causes fluid to thereby be drawn from the large reservoir 16, through the aspirating tube 48. The fluid is therefore drawn into the flow of high pressure air or oxygen and emerges from the orifice 40 in the form of a mist. Large droplets, generally undesirable for internally breathed aerosols, are caused to be impinged against baffle 56 and are allowed to drain downwardly and are collected in the medicament reservoir 30. This collected fluid is prevented from following the aspirating tube 48 through opening 50 in the medicament reservoir by means of the flanged shroud 54. The medicament reservoir 30 allows the collected fluid to drain normally through the opening 32 into the large reservoir 16, thereupon creating a recirculation circuit for collected fluid.

Further large droplets may be collected as the aerosol mist passes through the medicament reservoir and exits through the outlet means through deposition of such droplets along the internal surface of the passageways, and again, these collected droplets will ultimately be returned to the large reservoir 16.

In this manner, the unit functions as a high output nebulizer, taking outside atmosphere in through the inlet means and causing a fine aerosol mist to be exhausted through the outlet means. The aerosol fluid is withdrawn from the large reservoir and any large droplets that are collected and removed from the aerosol stream are eventually returned to the large reservoir.

In order to dispense a medicament in the nebulized stream, means are provided to interrupt the normally open communication between the medicament reservoir 30 and the large reservoir 16 and also to allow the introduction of medicament only into the nebulizer to be dispersed in atomized form.

Such means are provided through the use of flexible aspirating tube 48 which is adapted to be affixed in operative position in the opening 32 in the base of the medicament reservoir 30. As shown in FIG. 3 by the broken lines, and in FIG. 5, this junction may be accomplished by removal of the filter 58 which, as previously explained, is held to the end of aspirating tube 48 through a force fit to tapered fitting 60. After the removal of filter 58, the aspirating tube 48 is force fitted into the opening 32 which is tapered to accept tapered fitting 60 in a closer fitted junction. The loss of filter 58 is not detrimental to the function of the nebulizer due to the fact that only a medicament will now be drawn through aspirating tube 48 as there is very little impurity in medicaments, therefore rendering a filter as unnecessary.

A suitable medicament may now be introduced into medicament reservoir 30 and, as shown, may be poured in through the outlet tube 28 which is in direct communication with medicament reservoir.

In operation the medicament is thereupon withdrawn through sump opening 32 by the aspirating tube 48 to be nebulized in normal manner by the nebulizer 34, the mist produced leaving the apparatus through the outlet means.

Again, a recirculating circuit is provided for large droplets which are collected from the mist as they impinge against baffle 56 or are removed through deposition on the surface of passageways leading to the outlet means.

The collected fluid is caused to drain back into the medicament reservoir 30 and is retained there for further nebulization. As noted, the collected fluid is not allowed to drain through to the large reservoir 16 since the opening 32 has been closed through introduction of fitting 60 and no further communication is allowed between the medicament reservoir 30 and the large reservoir 16.

Due primarily to the small size of the medicament reservoir 30 and the location of the opening 32 in the lowermost location in the bottom of reservoir 30, the medicament may be al-

most entirely nebulized. In actual practice, a unit having a medicament reservoir 30 of a fluid capacity of about 150 cc. has been found to nebulize the fluid contained therein to all but 3 to 4 cc. of fluid, thus achieving almost complete nebulization of fluid such as an expensive medicament and also providing extremely accurate application of a prescribed dosage.

Thus, the construction of the apparatus provides a normally high output nebulizer having a means to dispense almost completely and independently a desired medicament easily and efficiently whenever desired, and therefore further provides a highly advantageous compact unit for use in separately administering a normal nebulization mist and a nebulized medicament mist.

While a preferred embodiment of this invention has been shown and described herein, it will be understood that other modifications thereof will readily occur to those skilled in the art and that the invention is intended to be limited only to the appended claims and to equivalent structure thereto.

I claim:

1. A nebulizer apparatus comprising a casing, inlet means and outlet means associated with said casing, nebulizer means adapted to produce a mist upon introduction of a fluid thereto, first and second fluid reservoirs associated with said casing, said first and second fluid reservoirs being normally in open communication with each other, tube means for normally withdrawing fluid from said first fluid reservoir to supply a first fluid to said nebulizer means, and means to block communication between first and second reservoirs whereby said tube means withdraws fluid from said second reservoir for supplying a second fluid to said nebulizer means.

2. A nebulizer apparatus as set forth in claim 1 further including means to collect and return excess first fluid droplets from the mist to said first fluid reservoir;

3. A nebulizer apparatus as set forth in claim 2, further including means to collect and return excess second fluid droplets from the mist to said second fluid reservoir.

4. A nebulizer apparatus of claim 1 wherein said tube means comprises a downwardly extending flexible tube normally terminating adjacent the lowermost area of said first fluid reservoir.

5. A nebulizer apparatus of claim 4, said flexible tube being adapted to be removed from association with said first fluid and repositioned to withdraw a second fluid within said second fluid reservoir, and wherein said flexible tube thereby blocks fluid communication between said second fluid reservoir and said first fluid reservoir.

6. A high output nebulizer apparatus comprising an outer casing, inlet means and outlet means associated with said casing, a first fluid reservoir and a second fluid reservoir within said casing, nebulizer means disposed intermediate said inlet means and said outlet means for producing a mist upon the introduction of a fluid thereto from said respective reservoirs, means for effectively and independently introducing a first fluid and a second fluid to said nebulizer means, and means to collect and return excess droplets of first and second fluid from the mist to said respective first and second reservoirs.

7. A nebulizer apparatus comprising a casing, inlet and outlet means associated with said casing, nebulizer means located intermediate said inlet and outlet means, said nebulizer means being adapted to produce a mist upon introduction of a fluid thereto, first and second fluid reservoirs within said casing for containing, respectively, a first and a second fluid, and means communicating with said nebulizer means for selectively and independently supplying fluid from either of said first and second fluid reservoirs whereby a mist may be produced having as a constituent either of the first or second fluids.